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ABSTRACT

Literature on female learning styles was reviewed to suggest implications for traditionally male vocational-technical education programs. The study focused on comparing and contrasting cognitive styles, a learning style dimension, between females and males. The field-dependent/independent distinction was found to be important for traditionally male programs or courses. (Field independents have the ability to separate parts from the field while field dependents perceive the field holistically as a unit.) Previous research showed that field-dependents tend to select people-oriented professions and that field-independents are in more impersonal, often more technical professions. Females tend to be slightly more field-dependent than males. Study findings were that (1) learner career choices are influenced by learning styles, course experiences, and teachers; (2) a link exists between how teachers learn and teach; and (3) students learn best when teaching styles are matched to student learning styles. Implications for vocational-technical education included varied teaching methods to accommodate learning-style differences and varied content, method, and delivery of workshop presentations to attract women to nontraditional programs. Hypotheses for additional research were also suggested. (YLB)

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Final Report

Project No. DVE 1-2C21

From July 1, 1981 to June 30, 1982

Learning Styles of Females and Implications for Vocational-Technical Education: a Review of the Literature

Pensacola Junior College
1000 College Boulevard
Pensacola, Florida

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ABSTRACT OF THE FINAL REPORT

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Project Director:	Ronald J. Berthelot
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PROBLEM

How do females learn and what implications do female learning styles have for traditionally male vocational-technical education programs?

OBJECTIVES

The objectives of the study are: 1) to search the literature on learning styles of females, 2) to compare and contrast learning styles between females and males, 3) to suggest implications for traditionally male programs in vocational-technical education, and 4) to formulate hypotheses for additional research on learning styles in vocational-technical education.

RESULTS AND POTENTIAL UTILIZATION

This study offers a review of the literature on learning style models, characteristics, and dimensions. The study focuses on comparing and contrasting cognitive styles, a learning style dimension, between females and males; implications, recommendations, and hypotheses for additional research are shown for traditional male vocational-technical education. Among the findings are that 1) learner career choices are influenced by their particular learning styles, course experiences, and teachers, 2) a link exists between how teachers learn and teach, and 3) students learn best when teaching styles are matched to student learning styles. Results of this study will be made available to vocational educators and other individuals interested in learning styles and their implications for vocational-technical education.

INTRODUCTION

Over half a million women were employed in 1978 as skilled blue-collar workers in occupations such as electricians, construction workers, welders, machinists, and auto mechanics (Hernandez, 1980). The number of women entering the work force in jobs traditionally considered for "men only" is expected to increase in the future.

Along with the increase in employment of women in blue-collar jobs, is an increase of women enrolled in traditionally male post-secondary vocational-technical education programs. Hernandez (1980), for example, indicated that the number of females studying new craft or trade skills in apprenticeship programs nationwide increased from .7% of total enrollment in 1973 to 2.6% in 1978. The same trend was recorded at Pensacola (Florida) Junior College. A survey of beginning students in the college's Department of Industrial-Technology conducted in September 1980 showed that 6% (16 of 263) of new enrollees were women, nearly two times more than the previous year (Berthelot, 1980). Now that they are here, what should we do with them? How can we best assist their learning?

First we must understand how women learn. Learning style differences between males and females appear to be an important area of consideration. According to Reichmann (1979) learning styles of students may be better predictors of course success than are demographic variables of students. In other words, the manner in which learners process information has greater educational implications than do physical stature, age, or sex.

Fennema (1976) and others define student learning styles as a set of attitudes and behaviors related to learning. This researcher wondered if there were differences between female and male learning styles -- differences that could affect the process of vocational-technical education.

This study examined learning styles of women and related implications for traditionally male programs in vocational-technical education. The study was designed to provide information to practitioners and researchers about sex differences in the cognitive style domain. Although cognitive styles have particular implications for vocational-technical education (Hartnett, 1973), cognitive styles have been largely ignored by many educators (Nelson, 1977), and seem to lack a firm theoretical base (Denson, 1977).

Although the literature showed no cognitive style theory directly linked with vocational-technical education, theory does assist in identifying learning styles, their characteristics, and strategies. Strategies are learned behaviors formed when learning styles are inappropriate (Even, 1982). For example, a non-reader may rely on reading chapter summaries or interacting with other students to solicit material rather than reading a textbook.

French (1977) suggested a theoretical list of available styles, characteristics, and strategies. He indicated the following learning styles and characteristics:

1. aural (a learner who listens but talks little),
2. visual (one who is image oriented),
3. oral/interactive (a person who talks frequently),
4. print-oriented (someone who functions best when reading and/or writing),
5. tactile (a student who feels touch is important),
6. motor (a learner who must be physically active and in motion), and
7. olfactory (an individual who uses the senses of smell or taste).

Styles and instructional strategies may be grouped according to French's model.

Styles	Strategies
1. motor/tactile	1. lab activities, student demonstration of manipulative skills, role play, assembly and disassembly of equipment or objects
2. aural/visual	2. audio visual presentations, use of graphs and charts, panel discussions, mockups, and field trips
3. oral (interactive)	3. student reports or presentations, small group discussions, question and answer sessions
4. olfactory	4. demonstration or presentation of material in which smell and taste facilitate understanding such as recognizing the odor from overheating electric motors or chemicals
5. print orientation	5. distribution of course outlines, assignment of reading, writing, or calculating exercises, paper and pencil tests rather than activity testing

NEED FOR THE STUDY

Individuals have expressed preferences in the way they learn best (Omem, et. al., 1979; Price, 1977; Hartnett, 1973). Some evidence indicates that female learning styles are distinct from males (Bagnara, et. al., 1980; Burstein, et. al., 1980). For example, Nelson (1977) in her research on cognitive styles and sex roles indicated that females elected more people-oriented careers and males studied more technical careers because those fields were more appropriate to their learning styles. With increasing enrollment of women in technical areas, learning styles of females take on added significance. Thus, the need

exists to examine learning style differences between men and women at the post-secondary level. Understanding and appreciating any differences will help educators to effectively train and educate women (and men) for skilled jobs traditionally held by men.

PROBLEM STATEMENT

How do females learn and what implications do female learning styles have for traditionally male vocational-technical education programs?

PURPOSE AND OBJECTIVES

The purpose of this study is to review the literature on female learning styles and discuss implications of current knowledge to vocational-technical education.

The objectives of the study are:

1. to search the literature on learning styles of females,
2. to compare and contrast learning styles between females and males,
3. to suggest implications for traditionally male programs in vocational-technical education, and
4. to formulate hypotheses for additional research on learning styles in vocational-technical education.

METHOD

The study reviewed the literature on cognitive styles from the mid-seventies to date. This was a period of increasing enrollment of women in traditionally male programs of study. Also a preliminary review of the literature indicated that much cognitive style research and study was conducted during this period.

Services provided by the Florida Educator's Information Service (FEIS) and the Florida Resources in Education Exchange (FREE) were used to locate previous studies. The search concentrated on descriptors titled: cognitive styles, modalities (learning styles), sex differences in learning styles, learning styles, and female learning styles.

The researcher reviewed seventy-eight abstracts forwarded by FEIS and FREE. Full texts were ordered for 38 studies, reports or papers. Each of the papers was examined. Twenty-three were found appropriate to the current study.

Other sources such as the Education Index were also reviewed by the descriptors shown above.

RESULTS

Since no studies were found, empirical or otherwise, which directly related to learning styles of enrollees in traditionally male vocational-technical programs or courses, reportage will include other areas pertinent to this investigation. The following areas will be examined:

(1) learning style models and characteristics, (2) various cognitive style dimensions, and (3) the congruence between learning styles and teaching styles.

Learning Styles

Learning styles have a number of dimensions or areas, models, and characteristics within each dimension. The primary dimensions are affective, cognitive, and psychomotor. Affective, cognitive, and psychomotor are referred to as domains by Bloom (1956) and styles by Harren (1979), Lockheed (1977), and Nelson (1977). Both domains and styles or a combination of the two are used in this paper.

Models of learning styles and characteristics vary. Researchers such as Bloom (1956), Fennema (1976), Riechman (1979), Brainard and Ommen (1977), and others have provided various models and characteristics of learning styles. In his work on educational objectives, Bloom (1956) delineated affective, cognitive, and psychomotor domains of learning. Affective and cognitive domains are more dominate than psychomotor in most secondary and post-secondary schools. The affective domain includes values, attitudes, interests, and appreciation of learning or curriculum content. According to Bloom (1956), instructors are not very clear about the learning experiences appropriate to the affective area because objectives are not precisely stated. Part of the problem may be that educators have difficulty agreeing on definitions for attitudes, interests, or appreciation.

This difficulty in defining attitudes may cause inconclusive and contradictory results. Fennema's (1976) analysis of research on sex-related differences in mathematics mentioned that definitions varied from liking or disliking math to indicating that attitudes are variables which cannot be measured through ability testing. Difficulties in effectively dealing with affective styles have spawned greater attention to cognitive styles.

Bloom (1956) wrote that cognitive domains are areas which deal with the development of intellectual skills and abilities; the recognition or recall of knowledge is also part of this domain. Because cognitive behaviors are measurable and clearly defined, most of the work in curriculum development has focused on the cognitive domain (Bloom 1956). Vocational-Technical education includes a heavy dose of cognitive style characteristics along with lesser amounts of affective and psychomotor styles (Herrscher, 1981).

The cognitive domain, on which this study focuses, deals with the thinking processes. Cognitive styles according to Even (1982) are the ways in which people gather and process information to solve problems or how they work, learn, or act. People with wide ranging abilities may share the same cognitive learning styles (Nelson, 1977).

As stated by Brainard and Ommen (1977) the characteristics of cognitive styles are related to inanimate things (repair and maintenance of equipment) and oriented toward numeric functions: students with strong cognitive styles tend to perform better in "technical" classes such as electronics, engineering, or welding.

Cognitive Style Dimensions

Like learning styles, cognitive style is also delineated into other areas or dimensions. Among the dimensions are handedness, spatial ability, neurological or brain functioning and organization, and field-dependent/independent. While the literature shows studies in each of these areas, they are related to each other because of the common thread of cognitive styles; each will be examined.

Handedness. Handedness is physical in nature. Research is primarily concerned with how left or right-handed learners perform or solve problems. Patterson and Lovsky (1980) studied the success in design classes of left and right-handed female and male architecture students. Although prior research had shown that left-handed students performed better on certain design problems and survived architecture programs in higher proportions than right-handed peers, they found that right-handed females performed better than like handed males.

Spatial. In contrast to the physical nature of handedness is the mental functioning of spatial abilities. Spatial ability or visualization is the process used by individuals to manipulate objects mentally or in their mind's eye (Frieze, et. al., 1978; Fennema, 1976). During the process, learners use verbal or visual strategies, thinking in words or pictures. Friedman (1979), for example, in her work on spatial performance between the sexes, pointed out that females used more verbal strategies while males used a more visual approach in solving problems. These differences between men and women may be a product of neurological functioning.

Neurological. Research in the neurological areas has identified functioning differences between the right and left brain hemispheres (Bagnara, et. al., 1980; Burstein, et. al., 1980; Muenchow 1980). The left hemisphere is the speech (language, logic) center and the right is the spatial (map drawing, direction giving) and visual center. According to Muenchow (1980), males use the right hemisphere exclusively for spatial tasks or problem solving; females are likely to use both hemispheres to solve similar problems. Although males solve spatial problems more quickly than females (Friedman, 1979), women's ability to use both hemispheres is particularly important if brain damage is caused by an accident or a stroke. For example, Burstein et. al., (1980), reports that males show more language deterioration than females from left hemisphere damage.

Field-dependent/independent. The field-dependent/independent distinction is important for traditionally male programs or courses. Witkin, et. al., (1977) indicated that field-independents tended to study in programs requiring analytical, abstract, and impersonal spheres; field-dependents enrolled in areas that required interpersonal, non-scientific study or orientation. In other words field-dependents would be more comfortable in the helping professions and field-independents would likely fill the ranks of electronic technicians, engineers, and air conditioning repairers. Several studies have indicated that males tend to be more field-independent and females more field-dependent (Burstein, et. al., 1980). However, it is important to remember that field-dependent/independent characteristics appear in both sexes (Lockheed, 1977).

As described by Witkin, et. al., (1977), persons who are field-independent perceive analytically by identifying or experiencing parts of a field from the whole field; field-dependents are almost unable to distinguish parts from the whole but experience the field as having dominant features or properties. As an illustration, if individuals are shown a simple two-dimensional lined picture of a tilted container on a table top and asked to draw a line in the container to show it half-filled with water, field-independents would draw the line parallel to the table top. Field-dependents would draw the line parallel to the top and bottom of the container or at an angle to the table top (Liben, 1978).

Even (1982) in her research reported that field-dependents favor traditional sex roles, view events holistically, have difficulty with analytical problem solving, and generally enter the helping professions; field-independents are inner directed, independent, individualistic, have little difficulty with analytical problems, and prefer scientific or engineering fields.

Previous research on field-dependence/independence shows differences between the sexes (Purstein, et. al., 1980; Morrell, 1976). In her review of research on sex differences in cognitive functioning, Burstein, et. al., (1980) reported that males were more field-independent and females were more field-dependent. Liben (1978) found that males scored significantly better than females on a test measuring field-independence.

Morrell (1976) also found that females were consistently less field-independent than males, although differences were not statistically significant. Differences existed not only between genders for tests of field-dependence/independence, but also between the sexes for tests of field-dependence only.

Field-dependence/independence may relate to decision making. Lockheed (1977) examined decision-making skills of mixed-sexed groups. Subjects played a decision-making game of moving a token through a maze by casting a die. Each group was required to discuss potential moves among group members before moving the token. The object was to pass through the maze as quickly as possible with minimum moves. Videotaped results showed that field-dependent males were significantly more influential and active than field-dependent females. It is interesting to note that Lockheed found no differences between field-independent men and women; they were judged to be equally active and influential.

Finally, a few other important findings about sex-difference are shown in the literature. First, a study (Witkins, et. al., 1977) on the role of cognitive styles in academic evolution found no relationship in academic achievement between field-dependent and field-independent college students. In other words, cognitive functioning did not relate to grade point average or learners' performance in college courses or programs. Second, greater differences appear within sexes than between sexes (Muenchow, 1980) a fact that is not always appreciated by educators when designing curriculum or

recommending policy (Frieze, et. al., 1978). Third, Burstein, et. al., (1980) noted that results derived from studies of sex differences may be accompanied by strong personal feelings if taken out of context. For example, practitioners may be interested in using sex difference to advise or exclude students from certain career fields. Under this line of reasoning, agressive males would be suited for welding, construction, or management careers while nurturing females would be directed towards teaching, social work, or other helping professions (Frieze, et. al., 1978). Simply put, men and women are too often judged by gender only without regard to ability or individual uniqueness.

Learning Styles and Teaching Styles

Learning styles and teaching styles appear to be linked (Voe, 1978; French, 1977). According to Kraft (1976), teaching styles of professors tend to reflect their personality, needs, and skills. This pattern indicates why different sections of the same course may be unrelated in method, student-teacher involvement or course requirements (Hartnett, 1973).

Herren (1979) indicated that college men's and women's changes in career fields of study were significantly affected or influenced by instructors or course content they experienced. Students gravitated to fields in which instruction and course material matched their learning styles.

Price, et. al., (1977) in his research on learning styles reported that students are more motivated, have better attitudes, and have higher scores on exams when learning/teaching styles are matched. This reportage is extremely important to the whole process of education. Examining the characteristics of student and teacher cognitive styles reinforces Price's reportage.

Field-dependent and field-independent characteristics of students and teachers were presented by Even (1982). Field-dependent students favored traditional sex roles, viewed events holistically, had difficulty with analytical problem-solving, and generally entered the helping professions. Field-dependent teachers are more supportive, warm and caring, responsive to people's needs, and prefer descriptive or pictorial models of knowledge as opposed to analytical problem-solving. In other words, field-dependent students and teachers share common concerns, approaches to learning, and learning styles. The same is true for field-independent students and teachers.

Field-independent students were more inner directed, independent, analytical, individualistic, and likely to study scientific or technical fields. Teachers who are field-independent were concerned with proficiency of knowledge, developed student handouts in outline form, and preferred preparing lists of items to be learned (Even 1982).

Finally, Witkin, et. al., (1975) also reported on student and teacher characteristics. They wrote that field-independents learn concepts by hypothesis testing and reliance on authority. Field-independent teachers generally use the traditional lecture and discovery approaches

in their classes; their tests include more abstract and nonsocial items than those of field-dependent instructors. By contrast, field-dependent instructors prefer interaction through questions and answers to cover course content and introduce topics; their testing procedures are characterized as including lifestyle issues, discussion questions, and more subjective evaluations.

Training. The relationship between training (coaching) and student performance on spatial task tests relating to field-dependence/independence were the subject of research by Liben (1978) and Morrell (1976). In both studies, all subjects were administered an initial test; subjects not having a perfect score on the initial test were given training sessions and retested. Both researchers found that more males than females had perfect scores on the initial test. However, results varied after training and retesting in both studies.

Liben's (1978) data suggested that, after training, female and male performance scores were similar. Morrell (1976) found that training had little affect on changing performance scores between sexes; male scores were higher than female scores. Morrell (1976) confirmed that his results were similar to some earlier findings; however, he indicated that the findings from previous studies may not be justified. Earlier studies Morrell (1976) felt did not provide good feedback (coaching) and the time lapse between training and retesting was too long. Thus, suggesting that with effective training and retesting soon after training, student scores between the sexes will be more similar.

SUMMARY

In summary, cognitive styles are patterns of behavior employed by individuals to solve problems and process information. Cognitive style dimensions include handedness, spatial ability, neurological patterns, field-dependent and field-independent tendencies. Handedness studies are designed to determine how right and/or left-handed learners solve problems or perform. Spatial abilities are processes used by individuals to manipulate objects or situations mentally. Neurological research examines hemispheric functioning of the brain; the right side is the spatial or visual center while language and speech are located in the left side. Field-independents have the ability to separate parts from the field while field-dependents perceive the field holistically as a unit.

Previous research between the sexes showed that:

1. field-dependents tend to select people-oriented professions and field-independents are in professions which are more impersonal, often more technical,
2. decision-making skills within mixed-sexed groups show no differences between female and male field-independents and field-dependent females were less active and influential than male field-dependents,
3. females tend to be slightly more field-dependent than males,
4. a link exists between how teachers learn and how they teach,
5. career choices of men and women are greatly influenced by course experiences and by particular teachers,

6. when teaching styles are matched to student learning styles, students' exam scores improve and learners have better attitudes and higher motivation, and

7. training (coaching), if properly administered, may improve on spatial tasks relating to field-dependence/independence.

IMPLICATIONS AND RECOMMENDATIONS

This research suggests a number of implications and recommendations for vocational-technical education. First, vocational-technical educators' feelings must transcend the generally strong personal or societal feelings frequently associated with studies on sex differences; educators should make every effort to view research objectively and glean those elements which are useful to teaching and learning. Although this study showed some cognitive style differences between the sexes, it also indicates that learning abilities need not be impaired by those style differences. Thus, emotions may cloud the fact that females in traditionally male disciplines do have the ability to learn; vocational-technical educators must search for ways to tap this ability, and learning styles may hold the key.

Second, varied teaching methods could accomodate learning style differences among students. This is important. Females may tend to be more field-dependent than males, but there are both field-dependents and field-independents within genders. Muenchow (1980) indicates that differences within gender may be greater than between genders.

Vocational-technical education currently relies heavily on lectures and demonstrations. If learning style needs of field-dependents are to be met, for example, other methods must be sprinkled throughout a course. Interactive methods such as role play, small group discussions, or student presentations are worth considering.

Third, the content, method, and delivery of presentations in workshops on attracting more women in non-traditional programs of study are very important. It may be inappropriate to rely only on canned productions or video tapes showing program requirements, equipment used, employment potential, etc. spoken by someone nobody sees. A more appropriate way may include a panel discussion by peers, pictures showing students interacting with teachers, special projects developed by past and current program enrollees, introduction and identification of people who can assist with special problems or concerns, and having current women enrollees share their experiences with the group. In short, use variety. Take advantage of learning style differences.

Fourth, instructors should allow sufficient time for older adults of both sexes to complete exams. Timed tests may hinder student performance. Rather than scheduling a long test within a certain time frame, it may be better to administer two shorter exams.

Also, use a variety of test items on examinations. This will assure fairness and better gauge knowledge between learners. For example, the exclusive use of multiple-choice items may benefit those who are print oriented to the exclusion of visually oriented learners. But a combination of multiple-choice and graphic items will better measure knowledge of both print and visual learners.

Fifth, since previous research is inconclusive on the effects of training and field-dependence, short check-ups immediately after training may assist learners to be more proficient at problem-solving. Morrell (1976) indicated that time delays between training and retesting may be responsible for failure to effect change in field-dependents. However, Liben (1978) wrote that more specific training or instruction directed to learners improve performance, if retesting occurs shortly after training.

Sixth, course design must be flexible to allow for style differences in mixed sex groups. In electricity/electronic labs, for example, options should be available for students to work along or in groups; the environment should be such that students are free to interact and have freedom of movement. If written laboratory reports are required, one should allow flexibility in reportage, provide opportunities for students to share results in class, or discuss procedures and results. Quite often, students report laboratory findings or results on standard forms which are handed to the instructor for evaluation. Generally, the evaluation consists of a grade and cryptic verbage along the margin with little or no student/teacher interaction.

Seventh, the congruence between learning and teaching styles require special attention by vocational-technical educators. Traditionally male programs of study are staffed with mostly male faculty. The style in which teachers teach has added significance with increases in female enrollment. Vocational-technical educators must devote the best of their creative abilities to implement change. Adjusting and changing the way one teaches is difficult but necessary. Failure to make adjustments may continue to satisfy only the learning style needs of field-independent females and males. Field-dependent men and women may become discouraged and unable to cope.

Eighth, practitioners, vocational-technical educators, should be aware of learning styles and teaching styles. Whether individually or in organized concert with others, educators must realize the importance of style differences between students and themselves. Several steps may be taken to provide information, characteristics, and strategies. In the short term, seminars, workshops, or in-service programs should be implemented at all levels within the state. For the long term, written material should be developed for state-wide decimation; teacher training institutions should develop course material on learning styles as part of program requirements.

Ninth, a number of hypotheses for additional research are suggested as follows:

1. Learning styles found in traditionally male programs are those styles favoring males and not females.
2. In traditionally female programs, learning styles favoring females are commonly used.
3. The teaching styles of vocational-technical educators mirror their own learning styles, rather than those of their students.
4. Competency based instruction in traditionally male programs favor male, rather than female, learning styles and teaching styles,
5. Field-dependent males and females will perform better in related theory courses than field-independent men and women.
6. Manipulative skill success in welding or machining is more a product of eye-hand coordination than learning style differences between the sexes.
7. Training (coaching) if effectively presented and tested will equip field-dependent students with strategies (learned behaviors) needed to perform successfully in field-independent disciplines.

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